REMARKS

In response to the office action mailed July 2, 2009, Applicant has amended Claims 1 and 13 to place the application in better condition for allowance. Further, Claim 1 has been amended by deleting, from the group from which the polymeric species can be selected, hydroxyethyl starches and carboxymethyl starches, and inserting, as a polymeric species which can be used, methyl vinyl ether-maleic acid copolymer. Basis for this addition to Claim 1 can be found in Claim 13 as well as in Example 1 in the specification.

Applicant includes herewith a petition for a two months extension of time to respond to the office action as well as authorization for the Commissioner to charge deposit account No. 23-0920 for the petition fee as well as any other fee that may now be due.

The Office Action has rejected Claim 13 under 35 U.S.C. Section 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Specifically, the objection is due to the recitation of limitations in Claim 13 to which the Office Action finds no antecedent basis. Applicant has amended Claim 1 (from which Claim 13 depends) to include methyl vinyl ether-maleic acid copolymer as one of the polymeric species that can be used; as a result the rejection based on insufficient antecedent basis is overcome. The wording of Claim 13 has also been amended to overcome the indefiniteness relating to the use of the word "selected" in original Claim 13. Further, Claim 13 has been amended to correct the typographical error that was kindly pointed out in Paragraph 7 of the Office Action.

The Office Action has rejected Claims 1-3, 6, 7, 11 and 13 under 35 U.S.C. Section 102(b) as being anticipated by Maruhashi et al. (U.S. Patent No. 5,106,890) ("Maruhashi"). The Office Action has also rejected claims 4, 5, 8-10, 14 and 15 under 35 U.S.C. Section 102(b) as anticipated by or, in the alternative, under 35 U.S.C. Section 103(a) as obvious over Maruhashi. The Office Action also rejects Claim 16 under 35 U.S.C. Section 103(a) as being unpatentable over Maruhashi.

Maruhashi (US 5106890) deals broadly with two categories of polyvinyl alcohol/starch films. In a first category, the film comprises a polyvinyl alcohol having a degree of hydrolysis of at least 93% and a starch only. This category of films is exemplified by Examples 1-9. A second category of the films comprises a polyvinyl alcohol having a degree of hydrolysis of at least 93%, a starch and a cross-linking agent. This category of films is exemplified by Examples 10-18.

Both categories of film of Maruhashi have, as an essential component, a starch. Starches have been excluded from Claim 1 as amended, and thus Claim 1 (and accordingly also the claims dependent therefrom including Claims 2, 3, 6, 7, 11 and 13) are novel over Maruhashi. Furthermore, as regards Claim 13, it has been amended to specify that the complementary species of the barrier component are a polyvinyl alcohol and a methyl vinyl ether-maleic acid copolymer. Clearly, methyl vinyl ether-maleic acid copolymer is not taught in Maruhashi, and this thus provides the further point of distinction of Claim 13, as amended, over Maruhashi.

Turning now to the rejection of the claims on the basis of obviousness, it is necessary to deal with both the categories of polyvinyl alcohol/starch film that Maruhashi deals with, as outlined above, i.e. Category 1 films comprising only a polyvinyl alcohol and a starch, and Category 2 films comprising a polyvinyl alcohol, a starch and a cross-linking agent.

Category 1 films, i.e. the films comprising a polyvinyl alcohol and a starch only, are as indicated above, exemplified by Examples 1-9 of Maruhashi. In respect of these Category 1 films, Maruhashi is totally silent regarding the polyvinyl alcohol and the starch, in the polyvinyl

alcohol/starch film "being complementary in that they are bound together physically by interpolymer complexation to form an interpenetrating physical network which provides the barrier component".

Regarding the Category 2 films comprising polyvinyl alcohol, starch and a cross-linking agent and exemplified by Examples 10-18 of Maruhashi, there is still, it seems, some uncertainty with the Office Action as regards the concept of "interpolymer complexation", since the Office Action equates the "interpenetrating physical network barrier component" of Claim 1 with Maruhashi's "intermolecular cross-linked structure" – see paragraph 13 of the Office Action. However, "cross-linked" refers to a chemical reaction leading to the formation of covalent bonds. On the other hand, "interpolymer complexation" is specifically obtained through non-covalent interaction which leads to a physical network, as borne out by the words "interpenetrating physical network" in Claim 1.

The apparent uncertainty expressed in the Office Action in this regard continues in paragraph 18 where the Office Action notes "to have optimized the molecular weight of the starch component of the composition in order to achieve the best cross-linking between the components and thus the most beneficial barrier properties". It is emphasized that, to the contrary, "interpolymer complexation" explicitly does not involve cross-linking.

Thus, it would not have been obvious to a person of ordinary skill in the art to move from Maruhashi to the use of interpolymer complexes for application as gas barrier on packaging. Maruhashi does not teach or disclose (and this applies to its Category 1 film as well as to its Category 2 film) the use of interpolymer complexes and does not hint at this either. Regarding the Category 1 films of Maruhashi, interpolymer complex formation is not merely the combination of two polymers, but requires the selection of two complementary polymers on the basis of specific non-covalent interaction (such as hydrogen bonding) between the polymers.

The same applies to the Category 2 films of Maruhashi; furthermore, regarding the Category 2 films, cross-linking, as discussed above, is *not* the same as interpolymer complex formation.

Furthermore, it requires the selection of specific molar masses of the two polymers, selection of two polymers with a sufficient percentage of groups with potential for interaction, and selection of specific ratios between the two polymers, to achieve interpolymer complex formation and the desired substantial increase in barrier properties. Since Maruhashi neither discloses interpolymer complexes, nor discusses any of these considerations with a view on achieving maximum non-covalent interaction, it is non-obvious to a person of ordinary skill in the art to extrapolate from either of the categories of film in Maruhashi to the presently claimed invention.

Furthermore, not all of the starches, starch modification/preparation methods or blend ratios disclosed by Maruhashi would necessarily lead to interpolymer complex formation or to significant improvement in oxygen barrier properties. In this regard, the same arguments as were presented in the Reply and Amendment filed 9 April 2009 in respect of the Nakashio et al reference, and in fact those presented in the Reply and Amendment of 17 September 2008, apply.

As is known to a person of ordinary skill in the art, oxygen is a non-polar molecule whilst water is a polar molecule, capable of hydrogen bonding. Thus typically materials that have good oxygen barrier properties, have poor water barrier properties, and materials that have good water barrier properties, have poor oxygen barrier properties. Thus a hydrophobic polymer such as polypropylene has a comparatively low water permeability (51×10^{-13} cm^3 (@STP).cm/(cm^2.s.Pa)) but a comparatively high oxygen permeability (1.7×10^{-13} cm^3 (@STP).cm/(cm^2.s.Pa)), whilst a more hydrophilic polymer such as poly(ethylene terephthalate) has a better oxygen permeability (0.0257×10^{-13} cm^3 (@STP).cm/(cm^2.s.Pa)), but higher water permeability (113×10^{-13} cm^3 (@STP).cm/(cm^2.s.Pa)).

Thus, the best oxygen permeability materials usually have a high affinity for water, and when these materials absorb moisture, the oxygen permeability increases dramatically. Thus the materials that theoretically have the best oxygen barrier properties (such as poly(vinyl alcohol) with an oxygen permeability in dry state of 0.00023×10^{-13} cm^3 (@STP).cm/(cm^2.s.Pa)) are very sensitive to water – in fact poly vinyl alcohol is water soluble.

Interpolymer complex formation reduces moisture sensitivity, and due to the dense network formation, provides further reduced oxygen permeability. In this regard, reference is again made to the peer-reviewed study also referred to in the Reply and Amendment filed 9 April 2009, and a copy of which has previously been submitted to the USPTO:

> Labuschagne P, Germishuizen WA, Verryn, SMC, Moolman FS. 2008. Improved oxygen barrier performance of poly(vinyl alcohol) films through hydrogen bond complex with poly(methyl vinyl ether-co-maleic acid). *European Polymer Journal* 44(7):2146-2152.

Typically, moisture absorption by a film used for packaging, leads to substantial loss of barrier properties, to a level that is not useful or acceptable as a gas barrier (for gases such as oxygen or carbon dioxide). It is clear from Tables 1 and 2 of Maruhashi that all compositions presented in those tables have substantial moisture absorption and swelling (around 1.0 times swelling). Thus, none of these films will have significant /useful oxygen or carbon dioxide barrier properties and will not be usable as gas barriers for packaging as claimed in Claim 1. It is noteworthy that Maruhashi does not propose the application of its films for gas barrier applications, and has not measured the gas barrier properties of any of its films. It is expected that its films will have poor gas barrier properties.

Favorable reconsideration is respectfully solicited. Applicant has enclosed a petition for a two months extension of time as well as authorization to charge the associated fees to deposit account number 23-0920. Should any further petition be required, the Commissioner is

respectfully requested to consider this paper to be any such petition and is authorized to charge any petition fee, or other fee as required, to the above noted deposit account. Applicant respectfully requests allowance of Claims 1-11 and 13-16.

The Examiner is respectfully invited to contact the undersigned attorney upon entry of this amendment if further clarification can be made by such contact.

Respectfully submitted,

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